
केबलों के लिए अनुशासित करेंट रेटिंग

भाग 7 क्रासलिंकड पॉलीएथिलीन विद्युतरोधित थर्मोप्लास्टिक
आवरित केबलों

Recommended Current Ratings for Cables

Part 7 Crosslinked Polyethylene Insulated Thermoplastic
Sheathed Cables

ICS 29.080.20

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FOREWORD

This Indian Standard (Part 7) was adopted by the Bureau of Indian Standards, after the draft finalized by the Power Cables Sectional Committee had been approved by the Electrotechnical Division Council.

This standard has been formulated to provide to the users general guidance for loading of cables. The over-loading of cables shall reduce the life expectancy of cable and at the same time under-loading it shall mean uneconomic utilization of its capacity.

The current ratings have been calculated using the methods set out in IEC 60287. The conductor temperature limit of 90°C for the calculation of current ratings has been taken from IS 7098 (Part 2) : 2011 ‘Crosslinked polyethylene insulated thermoplastic sheathed cables — Specification: Part 2 For working voltages from 3.3 kV upto and including 33 kV (*second revision*)’.

The permissible current ratings have been specified for three commonly adopted conditions of installations, namely, laid direct in ground, laid in ducts, and for cables in air.

It is to be noted that no cable should be operated for extended periods at temperatures in excess of that specified for continuous operation. Selection of excess current protection should take account of this aspect.

Some parameters such as screen cross-sectional area and outer sheath thickness have an influence on the current rating of large cables. In addition, the method of screen bonding has to be taken into account in the current rating of single-core cables.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded value should be the same as that of the specified value in this standard.

*Indian Standard***RECOMMENDED CURRENT RATINGS FOR CABLES****PART 7 CROSSLINKED POLYETHYLENE INSULATED THERMOPLASTIC SHEATHED CABLES****1 SCOPE**

This standard (Part 7) covers recommended current ratings for crosslinked polyethylene insulated PVC sheathed cables covered by IS 7098 (Part 2), either laid in ground, in ducts or in air.

2 REFERENCE

The following standard contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated was valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standard indicated below:

<i>IS No.</i>	<i>Title</i>
7098 (Part 2) : 2011	Specification for crosslinked polyethylene insulated PVC sheathed cables: Part 2 For working voltages from 3.3 kV up to and including 33 kV

3 BASIC ASSUMPTIONS

The current ratings given in Tables 1 to 35 are on the following assumptions:

- a) Maximum conductor temperature : 90°C
- b) Thermal resistivity of soil : 1.5 K.m/W
- c) Ground temperature : 30°C
- d) Ambient air temperature : 40°C
- e) Depth of laying (measured to the cable axis or centre of the trefoil group) is taken as follows:
 - 1) 3.3, 6.6 and 11 kV cables : 900 mm
 - 2) 22 and 33 kV cables : 1 050 mm

4 METHODS OF INSTALLATION

The current ratings given in this standard are for methods of installation and are as given:

<i>Type of Cable</i>	<i>Type of Installation</i>	<i>Method of Installation</i>
(1)	(2)	(3)
Single-core	a) Laid direct in the ground	a) Three cables in trefoil groups touching, solid bonded
	b) In ducts	b) Three cables laid flat touching, solid bonded
	c) In air	a) Three cables in trefoil ducts touching, solid bonded. b) Three cables laid flat ducts touching, solid bonded.
Three core	—	a) Three cables in trefoil groups touching, solid bonded. b) Three cables flat touching, solid bonded
		Installed singly

5 CABLES IN BURIED TROUGHS FILLED WITH SAND

Where cables are installed in sand-filled troughs, either completely buried or with cover flush with the ground surface, there is danger that the sand shall dry out and remain dry for long periods. The cable external thermal resistance may then be very high and the cable may reach undesirably high temperatures. It is advisable to adopt the current ratings for cables buried direct using a value of 2.5 K.m/W for the thermal resistivity of the sand filling unless a specially selected filling has been used for which the dry resistivity is known.

6 CABLES IN UNVENTILATED FORMED TRENCHES/ TUNNELS

When cables are installed in unventilated formed trenches or tunnels, it is advisable to adopt the current ratings for cables laid in ducts.

7 SIZES OF THE DUCTS

The current ratings specified in the Tables 1 to 35 apply to cables laid in earthenware ducts with a thermal

resistivity of 1.2 K.m/W. The ratings are based on the assumption that the ducts are air filled. If the ducts have been filled with a material such as bentonite, then it is usual to adopt the current ratings for cables buried direct.

The combinations of duct and cable dimensions assumed are shown below:

<i>Overall Cable Diameter mm</i>	<i>Inside Duct Diameter mm</i>	<i>Outside Duct Diameter mm</i>
Up to and including 65	100	130
Above 65 and up to and including 90	125	160
Above 90 and up to and including 115	150	190

8 CABLES IN AIR

Single core cables are assumed to be spaced at least 0.5 times the cable diameter from any vertical surface and installed on brackets or ladder racks. Three-core

cables installed in air spaced at least 0.3 times the cable diameter from any vertical surface.

9 RATING FACTORS

9.1 The current ratings given in the respective tables apply to continuous loading of cables at a rated frequency of 50 Hz under the specific conditions of installation mentioned in **2** and **3**. For the various rating factors which may have to be used under different conditions, reference shall be made to appropriate from Tables 13 to 35.

9.2 The tabulated current ratings apply to a set of three single-core cables or one three-core cable forming a three-phase circuit. When a number of circuits are installed in close proximity the current rating should be reduced by the appropriate factor from Tables 26 to 35.

These factors should also be applied to groups of parallel cables forming the same circuit. In such cases, attention should also be given to the arrangement of the cables to ensure that the load current is shared equally between the parallel cables.

Table 1 Current Ratings (a.c.) for Two Single-Core Cables with XLPE Insulation, Copper Conductor and Rated Voltage 1.9/3.3 kV to 3.8/6.6 kV
(Clause 3)

Sl No.	Nominal Area of Conductor	Buried Direct in the Ground		In Single-Way Ducts		In Air	
		Trefoil	Flat Touching	Trefoil Ducts	Flat Touching Ducts	Trefoil	Flat Touching
	mm ²	A	A	A	A	A	A
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	25	127	130	113	111	148	151
ii)	35	151	155	135	132	179	183
iii)	50	178	181	158	154	214	218
iv)	70	216	220	192	187	267	271
v)	95	256	260	227	220	323	327
vi)	120	290	292	257	247	374	376
vii)	150	323	323	285	272	422	422
viii)	185	362	359	319	302	484	481
ix)	240	411	398	361	333	565	550
x)	300	456	435	400	363	641	615
xi)	400	508	474	443	393	734	690
xii)	500	559	509	486	420	828	761
xiii)	630	611	543	529	446	929	834
xiv)	800	638	549	549	447	1 002	872
xv)	1 000	672	569	575	460	1 083	927

Table 2 Current Ratings (a.c.) for Two Single-Core Cables with XLPE Insulation, Aluminium Conductor and Rated Voltage 1.9/3.3 kV to 3.8/6.6 kV
(Clause 3)

Sl No.	Nominal Area of Conductor	Buried Direct in the Ground		In Single-Way Ducts		In Air	
		Trefoil	Flat Touching	Trefoil Ducts	Flat Touching Ducts	Trefoil	Flat Touching
	mm ²	A	A	A	A	A	A
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	25	99	101	88	87	115	118
ii)	35	117	120	104	103	139	142
iii)	50	138	141	123	120	166	169
iv)	70	168	172	149	146	208	212
v)	95	200	204	177	172	252	256
vi)	120	227	230	201	195	292	296
vii)	150	252	255	223	215	329	333
viii)	185	285	287	251	241	380	383
ix)	240	326	323	286	270	448	444
x)	300	365	357	319	298	511	502
xi)	400	412	397	359	329	593	574
xii)	500	461	436	401	360	680	647
xiii)	630	514	475	445	390	777	725
xiv)	800	552	495	476	403	863	780
xv)	1 000	595	523	509	423	954	846

Table 3 Current Ratings (a.c.) for Two Single-Core Cables with XLPE Insulation, Copper Conductor and Rated Voltage 6.6/6.6 kV to 11/11 kV

(Clause 3)

Sl No.	Nominal Area of Conductor	Buried Direct in the Ground		In Single-Way Ducts		In Air	
		Trefoil	Flat Touching	Trefoil Ducts	Flat Touching Ducts	Trefoil	Flat Touching
(1)	mm ²	A	A	A	A	A	A
i)	25	127	130	113	111	150	153
ii)	35	151	155	134	132	181	185
iii)	50	178	181	158	154	216	219
iv)	70	216	220	191	186	269	273
v)	95	257	259	227	219	326	329
vi)	120	290	292	256	246	376	378
vii)	150	323	323	285	272	424	425
viii)	185	360	354	317	297	487	480
ix)	240	411	398	361	332	568	552
x)	300	456	435	399	362	643	616
xi)	400	508	474	443	392	735	690
xii)	500	559	510	486	420	828	761
xiii)	630	611	544	529	446	930	835
xiv)	800	639	550	550	448	1 003	873
xv)	1 000	672	569	575	460	1 083	927

Table 4 Current Ratings (a.c.) for Two Single-Core Cables with XLPE Insulation, Aluminum Conductor and Rated Voltage 6.6/6.6 kV to 11/11 kV

(Clause 3)

Sl No.	Nominal Area of Conductor	Buried Direct in the Ground		In Single-Way Ducts		In Air	
		Trefoil	Flat Touching	Trefoil Ducts	Flat Touching Ducts	Trefoil	Flat Touching
(1)	mm ²	A	A	A	A	A	A
i)	25	99	101	88	86	116	119
ii)	35	118	120	104	102	140	143
iii)	50	138	141	122	120	167	171
iv)	70	168	172	149	146	209	213
v)	95	200	204	177	172	254	258
vi)	120	227	230	200	194	294	298
vii)	150	252	255	223	215	331	335
viii)	185	284	284	250	238	383	384
ix)	240	326	323	286	270	450	446
x)	300	365	357	319	297	512	503
xi)	400	412	397	359	329	594	575
xii)	500	461	436	401	360	680	647
xiii)	630	514	476	445	390	778	725
xiv)	800	553	496	476	404	863	781
xv)	1 000	595	523	509	423	954	846

Table 5 Current Ratings (a.c.) for Two Single-Core Cables with XLPE Insulation, Copper Conductor and Rated Voltage 12.7/22 kV and 19/33 kV
(Clause 3)

SI No.	Nominal Area of Conductor	Buried Direct in the Ground		In Single-Way Ducts		In Air	
		Trefoil	Flat Touching	Trefoil Ducts	Flat Touching Ducts	Trefoil	Flat Touching
(1)	mm ²	A (3)	A (4)	A (5)	A (6)	A (7)	A (8)
i)	35	150	153	132	129	185	188
ii)	50	176	178	154	150	224	227
iii)	70	214	215	187	180	278	280
iv)	95	253	253	221	212	336	336
v)	120	285	284	249	236	386	384
vi)	150	317	313	276	260	434	429
vii)	185	355	346	308	286	494	485
viii)	240	404	387	350	320	575	556
ix)	300	442	413	382	339	644	611
x)	400	490	449	422	367	734	683
xi)	500	538	482	462	393	825	753
xii)	630	586	513	501	416	920	823
xiii)	800	629	540	550	447	1 014	890
	1 000	643	552	560	453	1 074	938

Table 6 Current Ratings (a.c.) for Two Single-Core Cables with XLPE Insulation, Aluminum Conductor and Rated Voltage 12.7/22 kV and 19/33 kV
(Clause 3)

SI No.	Nominal Area of Conductor	Buried Direct in the Ground		In Single-Way Ducts		In Air	
		Trefoil	Flat Touching	Trefoil Ducts	Flat Touching Ducts	Trefoil	Flat Touching
(1)	mm ²	A (3)	A (4)	A (5)	A (6)	A (7)	A (8)
i)	35	116	119	102	101	144	146
ii)	50	137	139	120	117	174	177
iii)	70	167	169	146	142	217	220
iv)	95	198	200	172	167	262	264
v)	120	224	225	195	188	302	303
vi)	150	249	249	217	207	339	340
vii)	185	280	279	243	231	389	387
viii)	240	321	316	278	261	455	449
ix)	300	355	343	307	282	515	501
x)	400	400	380	345	312	594	571
xi)	500	447	417	384	340	678	641
xii)	630	496	453	424	367	770	715
xiii)	800	543	486	475	402	866	789
xiv)	1 000	572	508	498	417	944	851

Table 7 Current Ratings for Three-Core Cables with XLPE Insulation, Copper Conductor and Rated Voltage 1.9/3.3 kV to 3.8/6.6 kV (Clause 3)

Sl No.	Nominal Area of Conductor	Buried Direct in Ground	In a Buried Duct	In Air
(1)	mm ² (2)	A (3)	A (4)	A (5)
i)	25	121	104	132
ii)	35	144	124	159
iii)	50	169	146	188
iv)	70	206	178	234
v)	95	246	212	284
vi)	120	278	240	326
vii)	150	310	268	368
viii)	185	350	302	422
ix)	240	401	353	492
x)	300	449	395	559
xi)	400	506	445	642
xii)	500	565	497	730

Table 8 Current Ratings for three-core cables with XLPE insulation, Aluminium Conductor and Rated Voltage 1.9/3.3 kV to 3.8/6.6 kV (Clause 3)

Sl No.	Nominal Area of Conductor	Buried Direct in Ground	In a Buried Duct	In Air
(1)	mm ² (2)	A (3)	A (4)	A (5)
i)	25	94	81	102
ii)	35	112	96	123
iii)	50	131	113	146
iv)	70	160	138	182
v)	95	191	165	221
vi)	120	216	187	254
vii)	150	241	208	286
viii)	185	273	236	330
ix)	240	315	277	385
x)	300	354	312	440
xi)	400	403	355	512
xii)	500	457	403	590

Table 9 Current Ratings for Three-Core Cables with XLPE Insulation, Copper Conductor and Rated Voltage 6.6/6.6 kV to 11/11 kV (Clause 3)

Sl No.	Nominal Area of Conductor	Buried Direct in Ground	In a Buried Duct	In Air
(1)	mm ² (2)	A (3)	A (4)	A (5)
i)	25	121	105	133
ii)	35	144	125	160
iii)	50	169	146	191
iv)	70	207	179	237
v)	95	245	213	286
vi)	120	278	241	329
vii)	150	311	269	371
viii)	185	349	308	422
ix)	240	401	354	493
x)	300	449	396	560
xi)	400	506	446	643
xii)	500	565	497	731

Table 10 Current Ratings for Three-Core Cables with XLPE Insulation, Aluminium Conductor and Rated Voltage 6.6/6.6 kV to 11/11 kV (Clause 3)

Sl No.	Nominal Area of Conductor	Buried Direct in Ground	In a Buried Duct	In Air
(1)	mm ² (2)	A (3)	A (4)	A (5)
i)	25	94	81	103
ii)	35	112	97	124
iii)	50	131	114	148
iv)	70	161	139	184
v)	95	190	165	222
vi)	120	216	188	256
vii)	150	242	209	288
viii)	185	273	240	330
ix)	240	315	278	387
x)	300	354	312	441
xi)	400	404	356	512
xii)	500	457	403	590

Table 11 Current Ratings for Three-Core Cables with XLPE Insulation, Copper Conductor and Rated Voltage 12.7/22 kV to 19/33 kV (Clause 3)

Sl No.	Nominal Area of Conductor	Buried Direct in Ground	In a Buried Duct	In Air
(1)	mm ² (2)	A (3)	A (4)	A (5)
i)	35	143	125	164
ii)	50	167	150	196
iii)	70	204	183	243
iv)	95	243	217	293
v)	120	276	246	336
vi)	150	307	275	378
vii)	185	346	313	431
viii)	240	398	360	503
ix)	300	446	403	571
x)	400	503	453	655
xi)	500	563	507	745

Table 12 Current Ratings for Three-Core Cables with XLPE Insulation, Aluminium Conductor and Rated Voltage 12.7/22 kV to 19/33 kV (Clause 3)

Sl No.	Nominal Area of Conductor	Buried Direct in Ground	In a Buried Duct	In Air
(1)	mm ² (2)	A (3)	A (4)	A (5)
i)	35	111	97	127
ii)	50	130	116	152
iii)	70	159	142	189
iv)	95	189	169	227
v)	120	215	192	262
vi)	150	239	214	294
vii)	185	270	245	336
viii)	240	312	282	393
ix)	300	351	317	448
x)	400	400	361	519
xi)	500	454	408	598

Table 13 Rating Factors for Variation in Ambient Air Temperature for Cables in Free Air
(Clauses 3 and 9.1)

Maximum Conductor Temperature °C	Ambient Air Temperature °C							
	25	30	35	40	45	50	55	60
90	1.14	1.10	1.05	1.00	0.95	0.89	0.84	0.77

Table 14 Rating Factors for Variation in Ground Temperature for Direct Buried Cables
(Clauses 3 and 9.1)

Maximum Conductor Temperature °C	Ground Temperature °C							
	15	20	25	30	35	40	45	50
90	1.12	1.08	1.04	1.00	0.96	0.91	0.87	0.82

Table 15 Rating Factors for Variation in Ground Temperature for Cables in Ducts
(Clauses 3 and 9.1)

Maximum Conductor Temperature °C	Ground Temperature °C							
	15	20	25	30	35	40	45	50
90	1.12	1.08	1.04	1.00	0.96	0.91	0.87	0.82

Table 16 Rating Factors for Depths of Laying for Direct Buried Cables
(Clauses 3 and 9.1)

Sl No.	Depth of Laying mm	3.3 kV, 6.6 kV and 11 kV Cables					22 kV and 33 kV Cables		
		Nominal Conductor Size, mm ²		Three-core			Nominal Conductor Size, mm ²		Three-Core
		≤185	>185	(3)	(4)	(5)	≤185	>185	(6)
(1)	(2)								(7)
i)	900	1.00	1.00	1.00	—	—	—	—	(8)
ii)	1 050	0.99	0.98	0.98	1.00	1.00	1.00	1.00	
iii)	1 200	0.97	0.96	0.97	0.99	0.98	0.98	0.99	
iv)	1 500	0.95	0.94	0.95	0.97	0.96	0.96	0.97	
v)	1 800	0.93	0.92	0.94	0.95	0.94	0.94	0.95	
vi)	2 000	0.92	0.91	0.93	0.94	0.93	0.93	0.94	
vii)	2 500	0.91	0.89	0.91	0.92	0.91	0.91	0.92	
viii)	3 000	0.89	0.87	0.90	0.90	0.89	0.89	0.91	

Table 17 Rating Factors for Depths of Laying for Cables in Ducts
(Clauses 3 and 9.1)

Sl No.	Depth of Laying mm	3.3 kV, 6.6 kV and 11 kV Cables					22 kV and 33 kV Cables		
		Nominal Conductor Size, mm ²		Three-core			Nominal Conductor Size, mm ²		Three-Core
		≤185	>185	(3)	(4)	(5)	≤185	>185	(6)
(1)	(2)								(7)
i)	900	1.00	1.00	1.00	—	—	—	—	(8)
ii)	1 050	0.98	0.98	0.99	1.00	1.00	1.00	1.00	
iii)	1 200	0.97	0.97	0.98	0.99	0.98	0.98	0.99	
iv)	1 500	0.95	0.94	0.96	0.96	0.96	0.96	0.97	
v)	1 800	0.93	0.92	0.95	0.95	0.95	0.94	0.96	
vi)	2 000	0.92	0.91	0.94	0.94	0.94	0.93	0.95	
vii)	2 500	0.90	0.89	0.93	0.93	0.92	0.90	0.94	
viii)	3 000	0.89	0.88	0.91	0.91	0.91	0.89	0.92	

Table 18 Rating Factors for Variations in Soil Thermal Resistivity for Single-Core 3.3 kV, 6.6 kV and 11 kV Cables Laid Direct in Ground
(Clauses 3 and 9.1)

Sl No.	Nominal Area of Conductor	Values of Soil Thermal Resistivity K.m/W					
		mm ²	1.0	1.2	1.5	2.0	2.5
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	25	1.17	1.09	1.00	0.89	0.80	0.74
ii)	35	1.18	1.10	1.00	0.89	0.80	0.74
iii)	50	1.18	1.10	1.00	0.88	0.80	0.74
iv)	70	1.19	1.10	1.00	0.88	0.80	0.73
v)	95	1.19	1.10	1.00	0.88	0.79	0.73
vi)	120	1.19	1.10	1.00	0.88	0.79	0.73
vii)	150	1.19	1.10	1.00	0.88	0.79	0.73
viii)	185	1.19	1.11	1.00	0.88	0.79	0.73
ix)	240	1.19	1.11	1.00	0.88	0.79	0.73
x)	300	1.20	1.11	1.00	0.88	0.79	0.72
xi)	400	1.20	1.11	1.00	0.87	0.79	0.72
xii)	500	1.20	1.11	1.00	0.87	0.79	0.72
xiii)	630	1.20	1.11	1.00	0.87	0.79	0.72
xiv)	800	1.20	1.11	1.00	0.87	0.78	0.72
xv)	1 000	1.21	1.11	1.00	0.87	0.78	0.72

Table 19 Rating Factors for Variations in Soil Thermal Resistivity for Single-Core 3.3 kV, 6.6 kV and 11 kV Cables Laid in Buried Duct
(Clauses 3 and 9.1)

Sl No.	Nominal Area of Conductor	Values of Soil Thermal Resistivity K.m/W					
		mm ²	1.0	1.2	1.5	2.0	2.5
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	25	1.11	1.06	1.00	0.92	0.86	0.81
ii)	35	1.11	1.06	1.00	0.92	0.86	0.81
iii)	50	1.11	1.06	1.00	0.92	0.85	0.80
iv)	70	1.11	1.07	1.00	0.92	0.85	0.80
v)	95	1.11	1.07	1.00	0.91	0.85	0.79
vi)	120	1.12	1.07	1.00	0.91	0.84	0.79
vii)	150	1.12	1.07	1.00	0.91	0.84	0.79
viii)	185	1.12	1.07	1.00	0.91	0.84	0.78
ix)	240	1.13	1.07	1.00	0.91	0.84	0.78
x)	300	1.13	1.07	1.00	0.91	0.83	0.78
xi)	400	1.13	1.07	1.00	0.90	0.83	0.77
xii)	500	1.14	1.08	1.00	0.90	0.83	0.77
xiii)	630	1.14	1.08	1.00	0.90	0.83	0.77
xiv)	800	1.14	1.08	1.00	0.90	0.82	0.76
xv)	1 000	1.15	1.08	1.00	0.90	0.82	0.76

Table 20 Rating Factors for Variations in Soil Thermal Resistivity for Single-Core 22 kV and 33 kV Cables Laid Direct in Ground
(Clauses 3 and 9.1)

Sl No.	Nominal Area of Conductor	Values of Soil Thermal Resistivity					
		K.m/W					
	mm ²	1.0	1.2	1.5	2.0	2.5	3.0
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	35	1.17	1.09	1.00	0.89	0.81	0.74
ii)	50	1.17	1.09	1.00	0.89	0.81	0.74
iii)	70	1.17	1.09	1.00	0.89	0.80	0.74
iv)	95	1.17	1.09	1.00	0.89	0.80	0.74
v)	120	1.18	1.10	1.00	0.89	0.80	0.74
vi)	150	1.18	1.10	1.00	0.88	0.80	0.74
vii)	185	1.18	1.10	1.00	0.88	0.80	0.74
viii)	240	1.18	1.10	1.00	0.88	0.80	0.73
ix)	300	1.19	1.10	1.00	0.88	0.79	0.73
x)	400	1.19	1.10	1.00	0.88	0.79	0.73
xi)	500	1.19	1.10	1.00	0.88	0.79	0.73
xii)	630	1.19	1.10	1.00	0.88	0.79	0.73
xiii)	800	1.20	1.10	1.00	0.88	0.79	0.72
xiv)	1 000	1.20	1.11	1.00	0.88	0.79	0.72

Table 21 Rating Factors for Variations in Soil Thermal Resistivity for Single-Core 22 kV and 33 kV Cables Laid in Buried Duct
(Clauses 3.1 and 9.1)

Sl No.	Nominal Area of Conductor	Values of Soil Thermal Resistivity					
		K.m/W					
	mm ²	1.0	1.2	1.5	2.0	2.5	3.0
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	35	1.11	1.06	1.00	0.92	0.85	0.80
ii)	50	1.11	1.06	1.00	0.92	0.85	0.80
iii)	70	1.11	1.06	1.00	0.91	0.84	0.79
iv)	95	1.12	1.06	1.00	0.91	0.84	0.79
v)	120	1.12	1.07	1.00	0.91	0.84	0.79
vi)	150	1.12	1.07	1.00	0.91	0.84	0.79
vii)	185	1.13	1.07	1.00	0.91	0.84	0.78
viii)	240	1.13	1.07	1.00	0.91	0.83	0.78
ix)	300	1.13	1.07	1.00	0.90	0.83	0.77
x)	400	1.14	1.08	1.00	0.90	0.83	0.77
xi)	500	1.14	1.08	1.00	0.90	0.83	0.77
xii)	630	1.14	1.08	1.00	0.90	0.82	0.77
xiii)	800	1.14	1.08	1.00	0.90	0.82	0.77
xiv)	1 000	1.15	1.08	1.00	0.90	0.82	0.76

Table 22 Rating Factors for Variations in Soil Thermal Resistivity for Three-Core 3.3 kV, 6.6 kV and 11 kV Cables Laid Direct in Ground
(Clauses 3 and 9.1)

Sl No.	Nominal Area of Conductor	Values of Soil Thermal Resistivity					
		K.m/W					
	mm ²	1.0	1.2	1.5	2.0	2.5	3.0
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	25	1.15	1.08	1.00	0.90	0.82	0.76
ii)	35	1.15	1.08	1.00	0.90	0.82	0.76
iii)	50	1.15	1.08	1.00	0.90	0.82	0.76
iv)	70	1.15	1.08	1.00	0.89	0.82	0.76
v)	95	1.15	1.09	1.00	0.89	0.82	0.76
vi)	120	1.15	1.09	1.00	0.89	0.82	0.76
vii)	150	1.15	1.09	1.00	0.89	0.81	0.75
viii)	185	1.16	1.09	1.00	0.89	0.81	0.75
ix)	240	1.16	1.09	1.00	0.89	0.81	0.75
x)	300	1.16	1.09	1.00	0.89	0.81	0.75
xi)	400	1.16	1.09	1.00	0.89	0.81	0.75
xii)	500	1.16	1.09	1.00	0.89	0.81	0.75

Table 23 Rating Factors for Variations in Soil Thermal Resistivity for Three-Core 3.3 kV, 6.6 kV and 11 kV Cables Laid in Buried Duct
(Clauses 3 and 9.1)

Sl No.	Nominal Area of Conductor	Values of Soil Thermal Resistivity K.m/W					
		mm ²	1.0	1.2	1.5	2.0	2.5
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	25	1.08	1.04	1.00	0.94	0.89	0.84
ii)	35	1.08	1.04	1.00	0.94	0.88	0.84
iii)	50	1.08	1.04	1.00	0.94	0.88	0.84
iv)	70	1.08	1.04	1.00	0.93	0.88	0.83
v)	95	1.08	1.05	1.00	0.93	0.88	0.83
vi)	120	1.09	1.05	1.00	0.93	0.88	0.83
vii)	150	1.09	1.05	1.00	0.93	0.87	0.83
viii)	185	1.09	1.05	1.00	0.93	0.87	0.83
ix)	240	1.09	1.05	1.00	0.93	0.87	0.82
x)	300	1.09	1.05	1.00	0.93	0.87	0.82
xi)	400	1.09	1.05	1.00	0.93	0.87	0.82
xii)	500	1.10	1.06	1.00	0.92	0.86	0.81

Table 24 Rating Factors for Variations in Soil Thermal Resistivity for Three-Core 22 kV and 33 kV Cables Laid Direct in Ground
(Clauses 3 and 9.1)

Sl No.	Nominal Area of Conductor	Values of Soil Thermal Resistivity K.m/W					
		mm ²	1.0	1.2	1.5	2.0	2.5
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	35	1.14	1.08	1.00	0.90	0.83	0.77
ii)	50	1.14	1.08	1.00	0.90	0.83	0.77
iii)	70	1.14	1.08	1.00	0.90	0.83	0.77
iv)	95	1.14	1.08	1.00	0.90	0.83	0.77
v)	120	1.14	1.08	1.00	0.90	0.82	0.76
vi)	150	1.15	1.08	1.00	0.90	0.82	0.76
vii)	185	1.15	1.08	1.00	0.90	0.82	0.76
viii)	240	1.15	1.08	1.00	0.90	0.82	0.76
ix)	300	1.15	1.08	1.00	0.90	0.82	0.76
x)	400	1.16	1.09	1.00	0.89	0.82	0.76
xi)	500	1.16	1.09	1.00	0.89	0.82	0.75

Table 25 Rating Factors for Variations in Soil Thermal Resistivity for Three-Core 22 kV and 33 kV Cables Laid in Buried Duct
(Clauses 3 and 9.1)

Sl No.	Nominal Area of Conductor	Values of Soil Thermal Resistivity K.m/W					
		mm ²	1.0	1.2	1.5	2.0	2.5
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	35	1.08	1.05	1.00	0.94	0.88	0.83
ii)	50	1.08	1.05	1.00	0.93	0.88	0.83
iii)	70	1.08	1.05	1.00	0.93	0.87	0.83
iv)	95	1.09	1.05	1.00	0.93	0.87	0.83
v)	120	1.09	1.05	1.00	0.93	0.87	0.83
vi)	150	1.09	1.05	1.00	0.93	0.87	0.82
vii)	185	1.09	1.05	1.00	0.93	0.87	0.82
viii)	240	1.09	1.05	1.00	0.93	0.87	0.82
ix)	300	1.09	1.05	1.00	0.93	0.87	0.82
x)	400	1.10	1.06	1.00	0.92	0.86	0.81
xi)	500	1.10	1.06	1.00	0.92	0.86	0.81

Table 26 Group Rating Factors for Circuits of Three Single-Core Cables Laid Direct in the Ground
(*Clauses 3, 9.1 and 9.2*)

Sl No.	Number of Circuits	Spacing Between Group Centre				
		Touching	200	400	600	800
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	2	0.73	0.83	0.88	0.90	0.92
ii)	3	0.60	0.73	0.79	0.83	0.86
iii)	4	0.54	0.68	0.75	0.80	0.84
iv)	5	0.49	0.63	0.72	0.78	0.82
v)	6	0.46	0.61	0.70	0.76	0.81
vi)	7	0.43	0.58	0.68	0.75	0.80
vii)	8	0.41	0.57	0.67	0.74	—
viii)	9	0.39	0.55	0.66	0.73	—
ix)	10	0.37	0.54	0.65	—	—
x)	11	0.36	0.53	0.64	—	—
xi)	12	0.35	0.52	0.64	—	—

Table 27 Group Rating Factors for Circuits of Three Single-Core Cables in Single-way Ducts
(*Clauses 3, 9.1 and 9.2*)

Sl No.	Number of Circuits	Spacing Between Group Centre				
		Touching	200	400	600	800
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	2	0.78	0.85	0.89	0.91	0.93
ii)	3	0.66	0.75	0.81	0.85	0.88
iii)	4	0.59	0.70	0.77	0.82	0.86
iv)	5	0.55	0.66	0.74	0.80	0.84
v)	6	0.51	0.64	0.72	0.78	0.83
vi)	7	0.48	0.61	0.71	0.77	0.82
vii)	8	0.46	0.60	0.70	0.76	—
viii)	9	0.44	0.58	0.69	0.76	—
ix)	10	0.43	0.57	0.68	—	—
x)	11	0.42	0.56	0.67	—	—
xi)	12	0.40	0.55	0.67	—	—

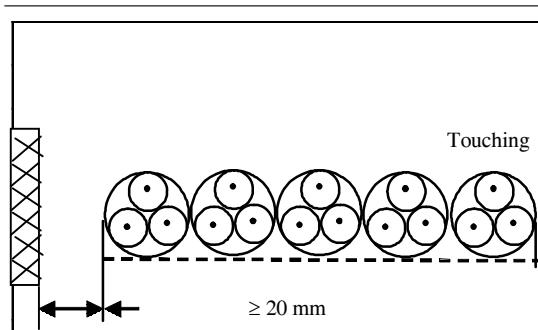
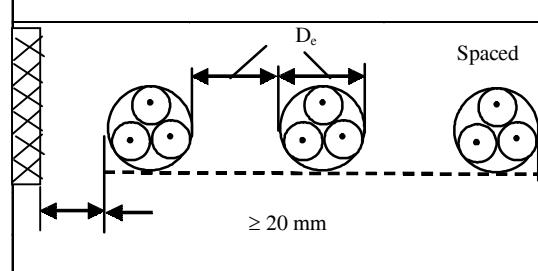
Table 28 Group Rating Factors for Three-Core Cables in Horizontal Formation Laid Direct in the Ground
(*Clauses 3, 9.1 and 9.2*)

Sl No.	Number of Cables	Spacing Between Group Centre				
		Touching	200	400	600	800
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	2	0.80	0.86	0.90	0.92	0.94
ii)	3	0.69	0.77	0.82	0.86	0.89
iii)	4	0.62	0.72	0.79	0.83	0.87
iv)	5	0.57	0.68	0.76	0.81	0.85
v)	6	0.54	0.65	0.74	0.80	0.84
vi)	7	0.51	0.63	0.72	0.78	0.83
vii)	8	0.49	0.61	0.71	0.78	—
viii)	9	0.47	0.60	0.70	0.77	—
ix)	10	0.46	0.59	0.69	—	—
x)	11	0.45	0.57	0.69	—	—
xi)	12	0.43	0.56	0.68	—	—

Table 29 Group Rating Factors for Three-Core Cables in Single Way Ducts in Horizontal Formation
(*Clauses 3, 9.1 and 9.2*)

Sl No.	Number of Cables	Spacing Between Group Centre mm				
		Touching (3)	200 (4)	400 (5)	600 (6)	800 (7)
(1)	(2)					
i)	2	0.85	0.88	0.92	0.94	0.95
ii)	3	0.75	0.80	0.85	0.88	0.91
iii)	4	0.69	0.75	0.82	0.86	0.89
iv)	5	0.65	0.72	0.79	0.84	0.87
v)	6	0.62	0.69	0.77	0.83	0.87
vi)	7	0.59	0.67	0.76	0.82	0.86
vii)	8	0.57	0.65	0.75	0.81	—
viii)	9	0.55	0.64	0.74	0.80	—
ix)	10	0.54	0.63	0.73	—	—
x)	11	0.52	0.62	0.73	—	—
xi)	12	0.51	0.61	0.72	—	—

Table 30 Group Rating Factors for Three-Core Cables in Air on Perforated Trays
(*Clauses 3, 9.1 and 9.2*)

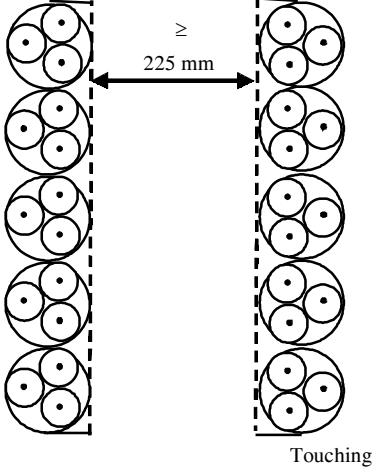
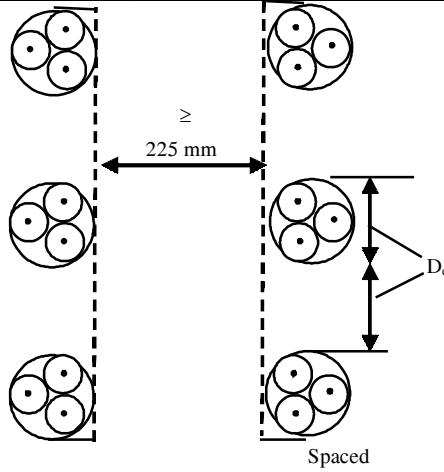
	Number of Trays	Number of Cables					
		1	2	3	4	6	9
	1	1.00	0.88	0.82	0.79	0.76	0.73
	2	1.00	0.87	0.80	0.77	0.73	0.68
	3	1.00	0.86	0.79	0.76	0.71	0.66
	1	1.00	1.00	0.98	0.95	0.91	—
	2	1.00	0.99	0.96	0.92	0.87	—
	3	1.00	0.98	0.95	0.91	0.85	—

NOTES

1 Factors apply to single layer groups of cables as shown above. Factors for cables installed in more than one layer touching each other shall be significantly lower and must be determined by an appropriate method.

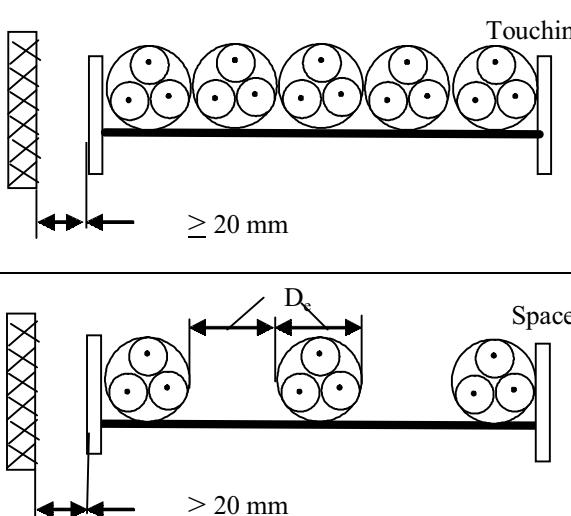
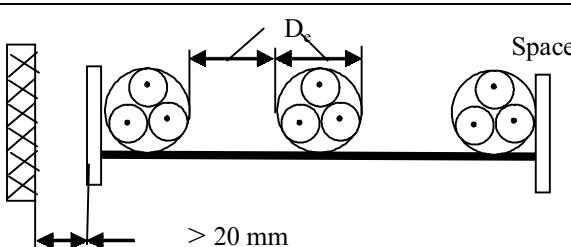
2 Factors are given for vertical spacing between trays of 300 mm and at least 20 mm between trays and wall. For closer spacing, the factors should be reduced.

Table 31 Group Rating Factors for Three-Core Cables in Air on Vertical Perforated Trays
(Clauses 3, 9.1 and 9.2)

	Number of Trays	Number of Cables					
		1	2	3	4	6	9
 Touching	1	1.00	0.88	0.82	0.78	0.73	0.72
	2	1.00	0.88	0.81	0.76	0.71	0.70
 Spaced	1	1.00	0.91	0.89	0.88	0.87	—
	2	1.00	0.91	0.88	0.87	0.85	—

NOTE — Factors are given for horizontal spacing between trays of 225 mm with trays mounted back to back. For closer spacing the factors should be reduced.

Table 32 Group Rating Factors for Three-Core Cables in Air on Ladder Supports, Cleats, etc
(Clause 3, 9.1 and 9.2)

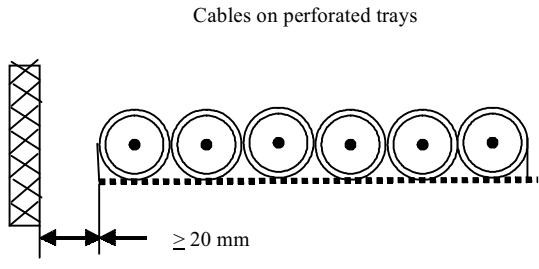
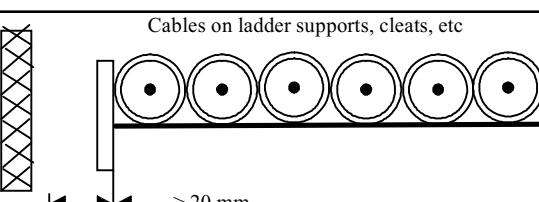
	Number of Trays	Number of Cables					
		1	2	3	4	6	9
		1	2	3	4	6	9
 Touching $\geq 20 \text{ mm}$	1	1.00	0.87	0.82	0.80	0.79	0.78
	2	1.00	0.86	0.80	0.78	0.76	0.73
	3	1.00	0.85	0.79	0.76	0.73	0.70
 Spaced D $\geq 20 \text{ mm}$	1	1.00	1.00	1.00	1.00	1.00	—
	2	1.00	0.99	0.98	0.97	0.96	—
	3	1.00	0.98	0.97	0.96	0.93	—

NOTES

1 Factors apply to single layer groups of cables as shown above. Factors for cables installed in more than one layer touching each other shall be significantly lower and must be determined by an appropriate method.

2 Factors are given for vertical spacing between trays of 300 mm and at least 20 mm between trays and wall. For closer spacing, the factors should be reduced.

Table 33 Group Rating Factors to be Applied for Circuits of Three Single Core Cables in Air Flat Touching
(Clause 3, 9.1 and 9.2)

	Number of Trays	Number of Three-Phase Circuits		
		1	2	3
		1	2	3
 Cables on perforated trays $\geq 20 \text{ mm}$	1	0.98	0.91	0.87
	2	0.96	0.87	0.81
	3	0.95	0.85	0.78
 Cables on ladder supports, cleats, etc $\geq 20 \text{ mm}$	1	1.00	0.97	0.96
	2	0.98	0.93	0.89
	3	0.97	0.90	0.86

NOTES

1 Factors are given for single layers of cables as shown above. Factors for cables installed in more than one layer touching each other shall be significantly lower and must be determined by an appropriate method.

2 Factors are given for vertical spacing between trays of 300 mm and at least 20 mm between trays and wall. For closer spacing, the factors should be reduced.

3 For circuits having more than one cable in parallel per phase, each three phase set of conductors should be considered as a circuit for the purpose of this table.

Table 34 Group Rating Factors to be Applied for Circuits of Three Single Core Cables in Air on Perforated Trays and Ladder Supports in Trefoil Formation
(Clauses 3.1, 9.1 and 9.2)

Cables on perforated trays	D_e	Number of Trays	Number of Three-Phase Circuits		
			1	2	3
		1	1.00	0.98	0.96
		2	0.97	0.93	0.89
		3	0.96	0.92	0.86
Cables on ladder supports, cleats, etc	D_e				
		1	1.00	1.00	1.00
		2	0.97	0.95	0.93
		3	0.96	0.94	0.90

NOTES

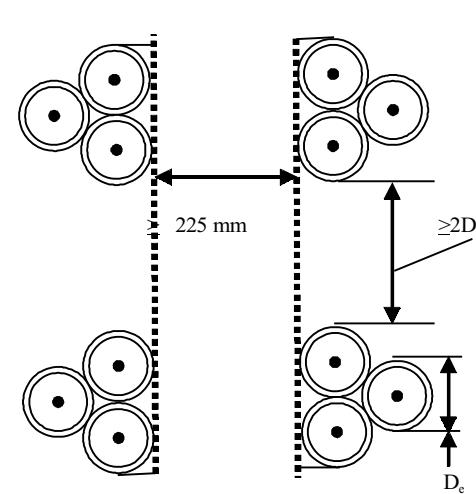
1 Factors are given for single layers of trefoil groups as shown above. Factors for trefoil groups installed in more than one layer touching each other shall be significantly lower and must be determined by an appropriate method.

2 Factors are given for vertical spacing between trays of 300 mm and at least 20 mm between trays and wall. For closer spacing, the factors should be reduced.

3 For circuits having more than one cable in parallel per phase, each three phase set of conductors should be considered as a circuit for the purpose of this table.

Table 35 Group Rating Factors to be Applied for Circuits of Three Single Core Cables in Air on Vertical Perforated Trays in Trefoil Formation
(Clauses 3, 9.1 and 9.2)

Number of Trays	Number of Three-Phase Circuits		
	1	2	3
1	1.00	0.91	0.89
2	1.00	0.90	0.86



NOTES

- 1 Factors are given for single layers of trefoil groups as shown above. Factors for trefoil groups installed in more than one layer touching each other shall be significantly lower and must be determined by an appropriate method.
- 2 Factors are given for horizontal spacing between vertical trays of 225 mm with trays mounted back to back. For closer spacing the factors should be reduced.
- 3 For circuits having more than one cable in parallel per phase, each three phase set of conductors should be considered as a circuit for the purpose of this table.

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Amendments Issued Since Publication

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